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EXAMINER

DOVE, TRACY MAE

ART UNIT	PAPER NUMBER
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1745

DATE MAILED: 05/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Best Available Copy

Office Action Summary

Application No.

10/038,556

Applicant(s)

SHEMBEL ET AL.

Examiner

Tracy Dove

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 March 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 3/10/05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

This Office Action is in response to the communication filed on 3/10/05. Applicant's arguments have been considered, but are not persuasive. Claims 1 and 3-25 are pending. Claims 2 and 26-36 have been canceled.

### *Continued Examination Under 37 CFR 1.114*

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/10/05 has been entered.

### *Specification*

The disclosure is objected to because of the following informalities: the specification recites "SPE electrolytes containing ...C-PVC....aprotic solvent (such as PC) and ...a alkali salt". The acronym "SPE" stands for solid polymer electrolyte. SPE electrolytes do not contain any liquid (hence the term solid). The cited section of the specification is describing a gel electrolyte because it is part solid (C-PVC) and part liquid (aprotic solvent). Solid polymer electrolytes are all solid materials and gel electrolytes are part solid/part liquid materials. The specification should be amended such that it is clear and concise. Solid polymer electrolytes do not contain any solvent. See at least page 21, lines 16-20.

Appropriate correction is required.

### ***Claims Analysis***

Note the specification states lithium batteries having polymer electrolytes are generally configured as gel-type polymer electrolyte which have liquid intermixed with a selected polymer electrolyte matrix material. The polymer electrolyte functions as a separator, being interposed between the cathode and anode films of the battery (page 5, lines 15-18). Thus, the modified polymer material of the present invention functions as a separator.

Note the “polymer electrolyte” of the claimed invention is a two phase material because the claims recite a gel electrolyte (C-PVC is solid part and solvent is liquid part).

### ***Claim Objections***

Claim 12 is objected to because of the following informalities: the claim recites “wherein said wherein said polymer electrolyte”. Examiner suggests “wherein said polymer electrolyte”. Appropriate correction is required.

Claim 13 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 13 does not further limit claim 12.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1 and 3-25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a homogeneous solution (single liquid phase) of C-PVC,

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a salt of an alkali metal and an aprotic solvent, does not reasonably provide enablement for any homogeneous material (single solid phase or single gas phase) of C-PVC, a salt of an alkali metal and an aprotic solvent. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. Applicant states the added limitation “as a homogeneous material” is disclosed in the specification at page 21, lines 11-15. However, the specification specifically recites “a substantially homogenous *solution*”. Furthermore, this is a product by process claim limitation since the polymer electrolyte of the claimed invention must be a gel electrolyte (heterogeneous solid/liquid phases). Specifically, the modified polymer is a solid material and functions as a separator. The aprotic solvent, by definition, is a liquid.

Claims 4, 5, 16 and 17 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a polymer electrolyte comprising 1) a chlorinated polyvinyl chloride, propylene carbonate (PC) and  $\text{LiClO}_4$  having a conductivity of  $0.01 \text{ S/cm}^2$ , 2) a chlorinated polyvinyl chloride, PC, DME and  $\text{LiClO}_4$  having a conductivity of  $0.108 \text{ S/cm}^2$ , or 3) a chlorinated polyvinyl chloride, PC, EC and  $\text{LiPF}_4$  having a conductivity of  $0.066 \text{ S/cm}^2$  does not reasonably provide enablement for any polymer electrolyte comprising a modified halogen containing polymer, a salt and an aprotic solvent having a lithium ion conductivity between  $0.01 \text{ S/cm}^2$  and  $0.108 \text{ S/cm}^2$ . The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. Polymer electrolyte lithium ion conductivities for specific examples disclosed in the specification cannot be used to describe polymer electrolytes not encompassed by the specification example. Specifically, the application enables the specific

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lithium ion conductivity values disclosed in the examples only for the specific polymer electrolytes disclosed by the examples.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 3-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 12 recite the term “a solid homogeneous material”, which is improper. The electrolyte comprises the modified chlorine containing polymer, which is the “solid homogeneous material” of the electrolyte. Thus, “a solid homogeneous material” lacks proper antecedent basis in the claims. Examiner points out that the claims do not recite (and the specification does not support) a polymer electrolyte that consists of a homogeneous material.

Claim 14 recites the limitation "said modified halogen containing polymer material". There is insufficient antecedent basis for this limitation in the claim.

To the extent the claims are understood in view of the 35 U.S.C. 112, 1<sup>st</sup> and 2<sup>nd</sup>, rejections above, note the following prior art rejections.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an

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international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3, 6, 8, 10, 12-15 and 18-22 are rejected under 35 U.S.C. 102(e)/103(a) as being anticipated by, and alternatively unpatentable over, Chia et al., US 6,617,078 B1.

Chia teaches a lithium ion rechargeable battery having a negative electrode, a positive electrode and a separator/polymer electrolyte there between comprising a chlorinated polymer. The polymer is comprised of a chlorinated polyvinyl chloride (col. 2, lines 10-18). The chlorinated PVC may be used alone or blended with a terpolymer of vinylidene chloride. Chlorinated PVC is a well known commercially available material. Preferably the amount of chlorine is at least 57 percent bound chlorine in the polymer. Chlorinated PVC resins of different molecular weights and chlorine contents are commercially available (col. 3, lines 6-33). The electrolyte comprises a lithium salt dissolved in a mixture of organic solvents. The lithium salt may be LiPF<sub>6</sub>, LiClO<sub>4</sub>, LiAsF<sub>6</sub>, LiPF<sub>6</sub>, and combinations thereof. The solvent may be ethylene carbonate, propylene carbonate, dimethyl carbonate, and combinations thereof (col. 4, lines 51-col. 5, lines 4). See also Example 1. The anode is a lithiated carbon material (col. 3, lines 2-5). The anode may be a carbon-based material and the cathode may be a metal oxide

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(vanadium pentoxide) or lithium transition metal oxide (lithium manganese oxide) (col. 4, lines 8-20). The cathode comprises the chlorinated polymer.

Thus the claims are anticipated. The claims are alternatively unpatentable. Regarding the limitation "formed by dissolving...to form a homogeneous solution, and drying said homogeneous solution to remove said common solvent", the courts have ruled that product-by-process limitations, in the absence of unexpected results, are obvious. See MPEP 2113. Since the product of the claimed invention and the product of Chia are both polymer gel electrolytes (due to the aprotic solvent) having the same components, they appear to be the same.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 3-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alamgir et al., US 5,252,413 in view of Chang et al., US 5,389,463 and/or in view of Chia et al., US 6,617,078 B1.

Alamgir teaches a lithium battery using lithium ion conductive solid polymer electrolytes composed of solvates of lithium salts immobilized in a solid organic polymer matrix. In particular, lithium batteries using solid polymer electrolytes derived by immobilizing solvates formed between a lithium salt and an aprotic organic solvent(s) in polyvinyl chloride (PVC) are disclosed (abstract). The solid electrolyte comprises 50-90 wt% of the aprotic organic solvent, 5-30 wt% of PVC and 5-15wt% of the lithium salt (col. 4, lines 7-11). Figure 2 depicts results for

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a Li/LiMn<sub>2</sub>O<sub>4</sub> solid polymer electrolyte cell and Figure 3 depicts results for a carbon/ LiMn<sub>2</sub>O<sub>4</sub> solid polymer electrolyte cell. The lithium salt may be LiPF<sub>6</sub>, LiClO<sub>4</sub>, LiAsF<sub>6</sub> or LiPF<sub>6</sub>. The solvent may be ethylene carbonate, propylene carbonate or  $\gamma$ -butyrolactone (col. 3, lines 35-65). The negative electrode may contain a carbon material, lithium or a lithium alloy such as lithium-aluminum or lithium-tin. The positive electrode may contain MnO<sub>2</sub>, V<sub>6</sub>O<sub>13</sub>, V<sub>2</sub>O<sub>5</sub>, lithium manganese oxide, lithium polysulfide, polypyrrole, polythiophene or polyacetylene (col. 4, lines 12-42). Alamgir teaches a typical solid electrolyte comprises an aprotic solvent (propylene carbonate) containing a lithium salt (LiClO<sub>4</sub>) immobilized in PVC. The electrolyte has conductivities of  $0.9 \times 10^{-3} \text{ ohm}^{-1}\text{cm}^{-1}$  ( $0.9 \times 10^{-3} \text{ S/cm}$ ) at 20°C (2:18-22).

Alamgir does not explicitly state the solid organic polymer matrix (separator) of the solid polymer electrolyte contains chlorinated PVC or a chlorinated PVC having 60-72 wt% chlorine.

However, Chia teaches a lithium ion rechargeable battery having a negative electrode, a positive electrode and a separator/polymer electrolyte there between comprising a chlorinated polymer. The polymer is comprised of a chlorinated polyvinyl chloride (col. 2, lines 10-18). The chlorinated PVC may be used alone or blended with a terpolymer of vinylidene chloride. Chlorinated PVC is a well known commercially available material. Preferably the amount of chlorine is at least 57 percent bound chlorine in the polymer. Chlorinated PVC resins of different molecular weights and chlorine contents are commercially available (col. 3, lines 6-33). The electrolyte comprises a lithium salt dissolved in a mixture of organic solvents. The lithium salt may be LiPF<sub>6</sub>, LiClO<sub>4</sub>, LiAsF<sub>6</sub>, LiPF<sub>6</sub>, and combinations thereof. The solvent may be ethylene carbonate, propylene carbonate, dimethyl carbonate, and combinations thereof (col. 4, lines 51-col. 5, lines 4). See also Example 1. The anode is a lithiated carbon material (col. 3,

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lines 2-5). The anode may be a carbon-based material and the cathode may be a metal oxide (vanadium pentoxide) or lithium transition metal oxide (lithium manganese oxide) (col. 4, lines 8-20). The cathode comprises the chlorinated polymer.

Furthermore, Chang teaches a polyvinyl halide having a halogen content of at least about 55 wt% of the polymer. The polyvinyl halide may be polyvinyl chloride. The polyvinyl halide can be a post-halogenated polyvinyl halide such as chlorinated polyvinyl chloride (CPVC). The chlorine weight content of the post-halogenated polyvinyl halide should be at least about 60%, with greater than 65% being preferred (col. 4, lines 40-col. 5, lines 15).

Therefore, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one of skill would have been motivated to substitute the chlorinated PVC of Chia or Chang for the PVC of Alamgir in order to improve the properties of the battery. The use of chlorinated PVC shows enhanced high temperature stability of the battery and mechanical integrity of the separator/polymer (Chia; col. 3, lines 6-33). Chang teaches chlorinated PVC has high tensile strength and ductility (col. 3, lines 9-25). Alamgir, Chia and Chang all teach PVC materials for the separator/polymer matrix of a battery. Chia teaches that chlorinated PVC is a well known commercially available material for a battery separator/polymer matrix with different molecular weights and chlorine contents available. Chang teaches post-chlorinated PVC is a known material for use as a battery separator. Thus, one of skill would have found it obvious to substitute chlorinated PVC for the PVC of Alamgir because Chia and Chang teach chlorinated PVC is a well known battery separator/polymer matrix material.

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Regarding the chlorine content of the chlorinated PVC, Chang teaches the chlorine weight content of the post-halogenated polyvinyl halide should be at least about 60%, with greater than 65% being preferred. Chia teaches chlorinated PVC with an amount of chlorine of at least 57 percent and chlorinated PVC resins of different molecular weights and chlorine contents are commercially available.

Regarding the limitation “formed by dissolving...to form a homogeneous solution, and drying said homogeneous solution to remove said common solvent”, the courts have ruled that product-by-process limitations, in the absence of unexpected results, are obvious. See MPEP 2113. Since the product of the claimed invention and the product of the prior art are both polymer gel electrolytes (due to the aprotic solvent) having the same components, they appear to be the same.

### ***Response to Amendment***

The declaration filed under 37 CFR 1.132 filed 3/10/05 is insufficient to overcome the rejection of claims 1, 3, 6, 8, 10, 12-15 and 18-22 based upon Chia (US6,617,078) as set forth in the last Office action because: the declaration is not commensurate in scope with the claimed invention or the specification as filed.

The declaration filed under 37 CFR 1.132 filed 3/10/05 is insufficient to overcome the rejection of claims 1, 3, 6-15 and 18-22 based upon Alamgir (US5,252,413) in view of Chang (US 5,389,463) and/or Chia (US6,617,078) as set forth in the last Office action because: the declaration is not commensurate in scope with the claimed invention or the specification as filed.

The declaration states “The polymer electrolyte is a solid homogeneous (single phase) material that includes the modified polymer, a salt of an alkali metal and an aprotic solvent,

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where all the electrolyte components are uniformly distributed in the electrolyte". However, the specification does not support "a solid homogeneous (single phase) material". Furthermore, the terms "homogeneous" and "uniformly dispersed" are not equivalent terms. See attached definition of "homogeneous" from Hawley's Condensed Chemical Dictionary. Furthermore, the specification does not describe the "aprotic solvent" of the claimed invention as a plasticizer.

The declaration states the homogeneous *solution* described on page 21 of the specification is dried to form a solid homogeneous polymer electrolyte. The specification does not recite "to form a solid homogeneous polymer electrolyte". Furthermore, the electrolyte contains as much as 82 wt% of the aprotic solvent, a liquid. It is unclear how an electrolyte that contains up to 82 wt % of a liquid can be termed "a solid". The electrolyte described in the specification is a gel polymer electrolyte, not a solid polymer electrolyte.

The declaration admits the aprotic solvent is by definition a liquid, but states the solvent is no longer a liquid since it does not have the characteristic readiness to flow. Applicant is partially correct. The liquid is absorbed or complexed with the electrolyte which inhibits the ability of the solvent to "flow". However, the resulting polymer electrolyte is not a solid, but a gel. It is well known in the art that electrolyte are considered solid, liquid or gel electrolytes. Again the polymer electrolyte of the invention containing up to 82 wt% of the aprotic solvent is a gel polymer electrolyte, not a solid polymer electrolyte.

Applicant asserts the polymer electrolyte recited in claim 1 is quite distinct structurally when compared to conventional gel polymer electrolyte. Applicant has provided no evidence for this assertion. Furthermore, Applicant states "gel structures are multi-phase structures including a polymer first phase, a liquid electrolyte second phase including solvent and Li-salt, and often a

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third phase. This definition of “gel electrolytes” is incorrect. Linden, Handbook of Batteries, teaches “another class of polymer electrolyte called “gelled” electrolytes have been developed by trapping liquid solution of lithium salts in aprotic organic solvents into a solid polymer matrix”. The gel electrolytes are made by dropping liquid electrolyte solutions into polymer cages with an immobilization procedure such as cross-linking, gelification and casting (page 36.16). Linden clearly supports the Examiner’s position that the polymer electrolyte of at least claim 1 is a “gelled” electrolyte. Applicant’s argument that the polymer electrolyte of claim 1 is distinct structurally from a gel electrolyte is not supported by evidence, and therefore, not persuasive.

The declaration states homogeneous solid polymer-based electrolyte films based on other polymers have been known. Examiner points out that solid polymer materials that have absorbed liquid aprotic solvents (no free volume of solvent) are gel electrolytes, not solid electrolytes (see explanation above). Applicant points to two references, US2004/0253520 and US5,609,974 (“Sun”), that teach homogeneous solid polymer electrolyte films without phase separation. These references are not commensurate in scope with the instant specification or the claimed invention. Furthermore, Sun discloses “the use of the addition of plasticizers to polymer electrolytes to form “wet” or “gel electrolyte” which procedure does improve ambient temperature conductivity” (1:50-55). Sun teaches “the solid polymer electrolytes are preferably terpolymer based networks” have the structure shown in column 3. Claim 2 of Sun recites the solid polymer electrolyte “includes a plasticizer in said network”. Thus the “solid polymer electrolyte” referred to in Sun is the network polymer only. The plasticizer is included in the network and is termed a “gel” or “wet” electrolyte by Sun. Note US2004/0253520 was published on 12/16/04, which is after the filed date of the present application. Thus,

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US2004/0253520 cannot be used to show what was common or known to the skill artisan at the time the claimed invention was filed.

The declaration provides data that attempts to demonstrate the differences between the claimed polymer electrolyte and the gel electrolyte disclosed in Chia and/or Chang. However, evidence of unexpected results must distinguish the claimed invention over the prior art of record. Chang teaches the solid polymer electrolyte film “preferably has a substantially uniform void volume profile” (11:59-61) and the solid polymer electrolyte is formed from a uniformly dispersed solution. Thus, the solvent/salt would be dissolved evenly throughout the solid polymer electrolyte film (uniformly dispersed). Chia teaches “solid polymer electrolytes or plasticized polymer electrolyte” (2:49-50). Furthermore, Chia states that the electrolyte (salt and solvent) is added after the cell is formed, thus, the polymer electrolyte of Chia does not resemble the AFM polymer electrolyte shown in Figure 2 of the declaration. The electrodes that sandwich the polymer electrolyte would prevent an uneven surface, as asserted by Applicant. The data does not show that the polymer electrolyte of the claimed invention is structurally different from the polymer electrolyte of the prior art.

Applicant discussed the ion conductivity of the claimed invention. However, Applicant has not provided evidence the ion conductivity of the claimed polymer electrolyte is different from the ion conductivity of the polymer electrolytes of the prior art. Evidence of unexpected results must distinguish the claimed invention over the prior art of record.

### ***Response to Arguments***

Applicant's arguments filed 3/10/05 have been fully considered but they are not persuasive.

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35 U.S.C. 112, first paragraph

Applicant argues “clearly, if phase separation does not occur upon drying the homogeneous solution, a single phase homogeneous solid electrolyte results”. This argument does not overcome the enablement rejection because the specification does not state “phase separation does not occur”. Second, the liquid solvent does not become a solid upon drying (as admitted by Applicant), thus the polymer electrolyte, as a whole, is not a single homogeneous material. Applicant argues “the high ionic conductivity values obtained provide further evidence of the single phase electrolyte, since phase separation would reduce the ion conductivity towards values provided by conventional gel-electrolytes which are multi-phase structures”. However, the specification teaches “PVC is known to include a crystalline phase portion, where the overall degree of crystallinity is approximately 10%. Crystalline polymer regions generally result in degraded Li ion conductivity.” Therefore, the phase separation of the PVC affects the Li ion conductivity.

See response to the declaration for arguments regarding the teachings of Sun (5,609,974).

35 U.S.C. 102(e) in view of Chia (US6,617,078)

Applicant argues that Chia teaches a two phase electrolyte and the electrolyte fills the pores of the polymer. However, the electrolyte (solvent and salt) is absorbed by the solid polymer of Chia, hence, the teaching by Chia that the electrolyte is a gel polymer electrolyte. Both Chia and the claimed invention teach a two phase electrolyte wherein a chlorinated PVC polymer is a solid and an aprotic solvent is a liquid. The aprotic solvent is absorbed by the polymer to create a gel electrolyte without free liquid volume. Therefore, this argument is not

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persuasive. The electrolyte of Chia is a lithium-ion conducting polymer membrane which acts both as the separator and as the electrolyte (2:53-56).

35 U.S.C. 103(a) of Alamgir (US5,252,413) in view of Chia and/or Chang

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicant's arguments against Chang alone are not persuasive because Chang (secondary reference) has been used in combination with Alamgir (primary reference) to reject the claimed invention.

Applicant states "the PVC used by Alamgir is conventional PVC, not a modified chlorine containing polymer having an enhanced chlorine level claimed by Applicant's, such as C-PVC. However, Alamgir has not been applied as an anticipatory reference, but used in combination with Chia and/or Chang. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicant disagrees with the motivation to combine the cited prior art and presents arguments regarding lithium ion conductivities. However, the motivation statement provided by the Examiner did not recite anything about lithium ion conductivities. Examiner stated the use of chlorinated PVC shows enhanced high temperature stability of the battery and mechanical integrity of the separator/polymer (Chia; col. 3, lines 6-33). Furthermore, Alamgir teaches a typical solid electrolyte comprises an aprotic solvent (propylene carbonate) containing a lithium

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salt ( $\text{LiClO}_4$ ) immobilized in PVC. The electrolyte has conductivities of  $0.9 \times 10^{-3} \text{ ohm}^{-1}\text{cm}^{-1}$  ( $0.9 \times 10^{-3} \text{ S/cm}$ ) at  $20^\circ\text{C}$  (2:18-22).

Applicant's argument regarding the teachings of Alamgir are confusing. Applicant states that the impressive results which approach the extremely high ion conductivities demonstrated by Applicants, are achieved using unmodified PVC. Applicant appears to be arguing that one of skill would not have been motivated to use the C-PVC of Chia or Chang for the PVC of Alamgir because the lithium ion conductivity would not be improved. This is confusing considering the instant specification states "the polymer electrolyte formed from the modified (halogen enhanced) polymer material can improve the ionic conductivity of the polymer electrolyte (page 8, lines 9-17) and the fact that enhancing the halogen level of PVC increases lithium ion conductivity is the present inventive concept.

Applicant's argument that "the lack of reported Li ion conductivities reported by Chia suggests marginal results" is simply unfounded. The argument that "the expected low Li ion conductivity obtained from a hypothetical electrolyte based on Chang which would indicate to one having ordinary skill in the art at the time the invention that use of C-PVC instead of conventional PVC would degrade the  $10^{-3} \text{ ohm}^{-1}\text{cm}^{-1}$  at room temperature Li ion conductivities provided by the electrolytes disclosed by Alamgir" is likewise illogical and unreasonable.

It is important to point out that the PVC or C-PVC polymers of the prior art are not the only component of the polymer electrolyte that effects lithium ion conductivity. Specifically, the lithium salt and/or aprotic solvent significantly effects the ability of the polymer electrolyte to conduct lithium ions.

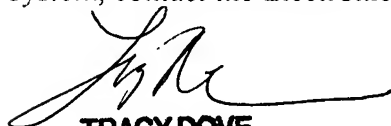
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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tracy Dove whose telephone number is 571-272-1285. The examiner can normally be reached on Monday-Thursday (9:00-7:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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**TRACY DOVE**  
**PRIMARY EXAMINER**

May 13, 2005